

## Suggested Guidelines for Rating Cardiac Disability in Workers' Compensation

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Cardiac disability ratings in workers' compensation cases currently lack any consistent scientific basis, with varying medical evidence used by different examiners in the same case. Opinions about the extent of disability may differ with the same patient, delaying resolution and the delivery of benefits. We describe guidelines for determining cardiac impairment and suggest a schedule for rating disability based on evidence. Our experience is in California, but arriving at equitable ratings for disability purposes is a nationwide challenge.

Exercise stress testing provides the best reproducible data to test the heart's ability to do work. When exercise stress testing is not possible or adequate, alternative or supplemental testing is necessary. Certain conditions, such as hypertension, arrhythmias, coronary artery spasm, and a history of coronary artery operations or myocardial infarction, may affect "cardiac disability" but may not necessarily be reflected in exercise testing.

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Workers' compensation laws provide benefits for permanent disability if a person is restricted or excluded from the job market because of limited function. Objective and subjective factors, prophylactic work limitations, or an inability to compete in the open labor market may lead to work restrictions and disability payments. Physicians do not have the last word.

Industrial accident commissions have disability rating specialists to interpret the disability schedule and to make recommendations about the extent of disability after decisions by administrative judges. Disability evaluation specialists are guided by legal definitions of subjective symptoms, which state that "minimal or mild" subjective symptoms constitute an annoyance only, "slight" symptoms mean there is some interference with the activity that produces symptoms, "moderate" symptoms markedly interfere with the activity, and "severe" symptoms mean the activity is precluded.

Eight guideline paragraphs have been adopted for evaluating disability of the lungs, heart, abdominal wall, and spine (Table 1).<sup>1</sup>

Cardiac disability ratings can be based on subjective reports of symptoms or estimates of limitations made by a patient, a physician, or both. These may vary considerably in the same case. With differing expert medical opinions, the question of the extent of disability frequently must be resolved through the full workers' compensation litigation procedure involving appeals to the Workers' Compensation Appeals Board, the District Court of Appeal, and occasionally the State Supreme Court.

In 1988 the Medical and Chiropractic Advisory Committee to the Administrative Director of the California Division of Industrial Accidents tried to develop guidelines allowing

cardiac disability to be rated more objectively and consistently, with appropriate scientific medical criteria. Representatives of groups who participate in the functioning of the workers' compensation system were consulted as to nonmedical matters pertinent to workers' compensation rating systems for cardiac disability.

### Guidelines for Evaluating Cardiac Impairment

#### *Exercise Stress Testing*

The advisory group decided that measuring the acceptable exertional level of sustained work—eight hours per day—relative to the maximum oxygen consumption (in liters per minute) was essential. The results of a literature search are shown in Table 2.<sup>2-13</sup> The subcommittee decided on 45% of maximum oxygen consumption as the upper limit for sustaining heavy work.

Exercise stress testing is currently the single most productive means of quantitating a worker's impairment. Protocols and guidelines for exercise testing on the treadmill using the Bruce protocol and bicycle ergometer have been documented by the American Heart Association,<sup>14</sup> Bruce,<sup>15</sup> Pollock,<sup>16</sup> and others. Results should be given in mets (metabolic equivalent system). Reports should also include any clinical signs or symptoms reported or observed, reports of ectopic ventricular or supraventricular activity, specific electrocardiographic (ECG) changes noted, and descriptions of and timing of development of symptoms such as dyspnea, angina, ischemic ECG changes, or arrhythmia. Blood pressure response to testing is also recorded.

The end point of exercise testing is vital in determining the safe level at which a person can work. It should determine either maximum capability or the point at which any of the symptoms and signs listed are developed. If the examiner

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does submaximal testing, for example, stopping at "90% of expected," 10% should be added to the mets level calculated from Bruce or other testing protocol tables. The examiner should specify which symptom(s) or sign(s) caused the testing to be stopped and fully explain why cardiac impairment, rather than some other condition, caused testing to be stopped. There is always the possibility that the person tested

TABLE 1.—The 'Guideline Paragraphs' Used for Evaluating Disability of the Heart in the California Schedule\*

Paragraph	Standard Disability Rating, %†	Description
a . . . . .	10	Disability precluding very heavy lifting contemplates that an employee has lost about a fourth of preinjury lifting capacity; a statement such as "unable to lift 50 lbs" is not meaningful; the total lifting effort, including weight, distance, endurance, frequency, body position, and similar factors, should be considered
b . . . . .	15	Disability precluding very heavy work contemplates that an employee has lost about a fourth of preinjury capacity for performing activities such as bending, stooping, lifting, pulling, and climbing or other activities involving comparable physical effort
c . . . . .	20	Disability precluding heavy lifting contemplates that an employee has lost about half of preinjury lifting capacity
d . . . . .	25	Disability precluding heavy lifting, repeated bending, and stooping contemplates that an employee has lost about half of preinjury capacity for lifting, bending, and stooping
e . . . . .	30	Disability precluding heavy work contemplates that an employee has lost about half of preinjury capacity for performing activities such as bending, stooping, lifting, pushing, pulling, and climbing or other activities involving comparable physical effort
f . . . . .	50	Disability resulting in limitation to light work contemplates that an employee can do work in a standing or walking position, with a minimum of demands for physical effort
g . . . . .	60	Disability resulting in limitation to semisedentary work contemplates that an employee can do work about half the time in a sitting position and about half the time in a standing or walking position with a minimum of physical effort, whether standing, walking, or sitting
h . . . . .	70	Disability resulting in limitation to sedentary work contemplates that an employee can do work predominantly in a sitting position at a bench, desk, or table with a minimum of physical effort and with some degree of walking and standing permitted

\*From State of California Department of Industrial Relations.<sup>1</sup>  
†Ratings are modified administratively to take into account age and occupation.

may not give full effort. If a person stops voluntarily before reaching what is considered maximum capability, the examiner should estimate what the actual testing end point should be, giving reasons. Important sections of the tracings must be enclosed with the report.

Symptoms and signs indicating the testing end point are as follows:

- Onset of atrial fibrillation;
- Onset of ectopic atrial tachycardia;
- Progressive drop in the heart rate as exercise continues or if the systolic blood pressure falls 10 mm below a previously measured level as exercise continues;
- Progressive ST segment elevation or depression;
- Progressive widening of the QRS complex;

- Premature ventricular contractions with progressive increasing frequency as the exercise progresses;
- Ventricular tachycardia (three or more consecutive beats);
- Excessive blood pressure rise (230 to 250 mm systolic);
- Subjective symptoms of dyspnea, undue fatigue, or dizziness;
- Progressive anginalike pain that in the examiner's opinion is cardiac-related. The examiner must fully explain if chest pain alone is a criterion for stopping.

Musculoskeletal pain or discomfort may limit the continuance of test; the end point in this event is not valid for an evaluation of cardiac impairment.

Pulmonary function testing may be needed to rule out pulmonary factors contributing to decreased exercise tolerance.

When testing has been completed and the end point in mets has been determined, a "safe" effort can be predicted. After reviewing the pertinent literature (see Table 2), we decided that if the testing end point is related to a poor state of physical fitness, the maximum short-term (less than 15 minutes once a day) work exertion allowed may be 80% of the end-point level. If a person is tested after medical intervention for cardiac ischemia and is asymptomatic off the treadmill, the maximum short-term work exertion allowed may be 80% of the testing end point in mets. If the testing end point is related to signs or symptoms of cardiac distress, the maximum short-term work exertion allowed should be 70% of the end-point level. The sustained level of work exertion for activities through most of the workday should be set at 45% of the testing end point in mets.

#### Alternative or Supplemental Testing

Other testing may be used if there are medical circumstances in which exercise testing is not possible or if the

TABLE 2.—Options on the Acceptable Exertional Level for Sustained (8 hours per day) Work, Relative to the Maximum Oxygen Consumption ( $\dot{V}O_{2max}$ ) Determined by Testing

Source, yr	Opinion of Acceptable Exertional Level
Astrand, 1960 <sup>2</sup> . . . . .	50% of $\dot{V}O_{2max}$ is upper limit for sustained heavy work
Muller, 1962 <sup>3</sup> . . . . .	20%
Bink, 1962 <sup>4</sup> . . . . .	33%
Eklom et al, 1968 <sup>5</sup> . . . . .	33% to higher rates increase level of blood lactate
Astrand and Rodahl, 1977 <sup>6</sup> . . . . .	30% to 40% suggested
Lind and Petrofsky, 1978 <sup>7</sup> . . . . .	45% to 55% for work involving lifting
NIOSH, 1981 <sup>8</sup> . . . . .	33%
Nelms, 1982 <sup>9</sup> . . . . .	50% should be attempted only by highly trained workers, such as lumberjacks
Ilmarinen, 1984 <sup>10</sup> . . . . .	30% without breaks, 50% with breaks
Astrand, 1988 <sup>11</sup> . . . . .	40% to 45% by choice—more than 50% leads to body temperature rise above 38°C; at 40%, heart rate is 125/min for 20- to 29-year age group
Haskell et al, 1989 <sup>12</sup> . . . . .	No more than 50%
Kilbom, 1980 <sup>13</sup> . . . . .	Work at 60% to 80% not recommended for more than 20 to 25 minutes (for short-term exertion)
Haskell et al, 1989 <sup>12</sup> . . . . .	No more than 80% for short-term exertion

NIOSH = National Institute of Occupational Safety and Health

examining physician thinks the performance of exercise testing by the applicant was spurious. Alternatives may be used, for example, when there are musculoskeletal handicaps that prevent exercise testing or when pre-exercise ECG changes such as left bundle branch block or myocardial infarction may make interpretation of ECG changes with exercise testing difficult. Exercise testing might be contraindicated in the presence of an ejection fraction of less than 20% or when there are recurrent complex cardiac arrhythmias, unstable angina, uncompensated heart failure, or Holter monitor or ECG demonstration of silent ischemia.

When alternative or supplemental testing is being used, the physician should consider whatever data are available from tests previously done, with the physician's opinion as to the validity of these data included in the report. Additional testing may be needed but must be verified by the physician. Even when exercise testing has been done satisfactorily and the allowable mets level for work determined, the data from tests previously done or from the additional testing or the existence of other ratable factors may suggest that modification of the allowable mets level is appropriate. All testing, exercise, or alternatives should be done after treatment and with the examinee under continuing treatment. To control costs, alternative testing to exercise testing must be justified and not repeated if appropriate testing results are available in a patient's record.

The ejection fraction may be used to estimate cardiac impairment in the absence of exercise testing or to modify or validate medical opinion based on exercise testing. An impairment may be present even when the ejection fraction is normal, such as with coronary occlusion. Therefore, ejection fraction measurement should supplement rather than replace exercise testing.

Cardiac catheterization with the direct measurement of cardiac output and cardiac index is the most accurate method of determining the ejection fraction. This would not be done routinely for workers' compensation disability evaluation. If it has been done recently, the information provided would be valuable. The physician should explain why the data are, or are not, considered relevant.

Alternatively, ejection fraction may be calculated from the results of an echocardiogram or a multigated angiogram (first-pass determination). Normal results should be stated. An ejection fraction of more than 55% is considered to be in the normal range, equivalent to cardiac performance to normal levels for age and sex. An ejection fraction of 45% to 55% represents slight impairment, 30% to 45% is moderate impairment, less than 30% is less than severe impairment, and less than 20% is severe impairment or total disability.

Information from the history may supplement exercise testing: activity levels reported can be translated into mets, previous exercise testing, or documented levels of exercise testing after injury, or documented levels of exercise programs in mets.

To determine if a person's injury is permanent and stationary, the current mets level must be compared with one taken earlier. One of these values should be used in this order:

1. Previous measurements by exercise testing;
2. If (1) is not available, translate activity within the past 5 years into mets;
3. If (1) and (2) are not available, translate nonwork activity into mets;

TABLE 3.—Maximum Oxygen Uptake ( $\dot{V}O_{2max}$ ) in Healthy 'Normal' Volunteers\*†

Age, yr	Mean $\dot{V}O_{2max}$ , ml/kg/min	10th Percentile	Mean	90th Percentile
<b>Men, mets</b>				
20-29.....	39	9.0	11.0	13.5
30-39.....	37	8.6	10.5	13.2
40-49.....	35.7	7.8	10.0	12.8
50-59.....	33	7.0	9.4	12.4
60+.....	29	5.7	8.2	11.7
<b>Women, mets</b>				
20-29.....	30.2	6.2	8.6	10.8
30-39.....	30.2	6.2	8.6	10.2
40-49.....	26.7	6.0	7.6	10.0
50-59.....	24.5	5.0	7.0	9.4
60+.....	21.8	4.5	6.2	8.6

\*Data from the Cooper Clinic Coronary Risk Factor Profile Charts, based on standards established at the Institute for Aerobics Research, Dallas, Texas, 1978 (from Pollock et al<sup>16</sup>).

†Maximum oxygen uptake was estimated from treadmill time.

4. If (1), (2), and (3) are not available, use the mean standard mets for age and sex from Table 3.<sup>16</sup>

Other notable factors such as coronary artery spasm, arrhythmias, cardiomyopathies, and hypertension should be described if they are present.

Coronary artery spasm must be diagnosed by ECG or Holter monitoring with ST segment changes elevated or depressed more than 1 mm. The Holter monitor must be a high-fidelity type and not a standard or event monitor. Important sections of the tracings, including scale and a technical description of the equipment used, should be included with the report.

The described level of emotional or physical stress, or both, producing spasm and subjective evaluation determine the extent of impairment. Nearly daily episodes of coronary artery spasm not controlled with medication represent severe impairment, episodes every week or two despite medication represent moderate impairment, and occasional episodes despite medication represent slight impairment.

Another factor of impairment may be the continuing need for medication. The examiner should describe the medication and any possible side effects, give their cause, and tell what if any restrictions are appropriate because of the side effects. If there are no notable side effects from the medication, this should be mentioned.

Arrhythmias should be evaluated after appropriate treatment and documented by data from ECG or Holter monitoring.

- On the treadmill, arrhythmias serve as end-point indicators and establish the impairment level.

- Occasional unifocal premature ventricular contractions with otherwise normal heart sounds represent no impairment unless temporarily related to stress or if a patient is preoccupied with symptoms.

- Ventricular arrhythmias in the presence of ventricular dysfunction or abnormality are associated with an increased risk of sudden cardiac death.

- Supraventricular arrhythmias may result in impairment related to the extent of subjective symptoms.

Cardiomyopathies of any cause are evaluated by exercise testing or by alternative testing if this is not possible, to determine the activity level allowed.

Hypertension is defined as a resting blood pressure of 140/90 mm of mercury or higher.<sup>17</sup> Controlled hypertension means a blood pressure at or lower than 140/90 mm of mercury. Incompletely controlled hypertension means an intermittent elevation of blood pressure higher than 140/90 mm of mercury. Uncontrolled hypertension means a blood pressure always higher than 140/90 mm of mercury.

With uncontrolled hypertension, treatment is needed, and the examinee may or may not be considered temporarily partially or totally disabled, pending such treatment.

In most persons, hypertension can be controlled with effective treatment. The medications and dosage as well as increases needed should be noted. Side effects may warrant an impairment rating and should be described and quantified, with their relationship to the medication explained.

During the testing of a person with controlled hyperten-

sion by ambulatory blood pressure monitor or treadmill, intermittent loss of control may be demonstrated. The level of physical or emotional stress producing loss of control may be a basis for an impairment rating. If there is end-organ damage with controlled hypertension, the examiner should describe and give the significance of it.

### Reaction to Emotional Stress

The relationship between emotional stress and heart disease is debated. Work restrictions to avoid emotional stress are regularly given and may constitute a disability. If the examiner thinks a preclusion from emotional stress is appropriate, the degree of the emotional stress to be precluded may vary, and thereby the degree of disability will vary. Physicians should specify examples of emotional stress to be avoided by the person examined, based on the person's experience.

Prophylactic restriction against all emotional stress might be given, for example, for recurrent complex cardiac arrhythmias persisting despite appropriate treatment; unstable angina or resting angina at a frequency of three or more times a week as documented by history; uncompensated heart failure; or ECG demonstration of silent ischemia persisting despite appropriate treatment documented by Holter monitoring and a diary.

Prophylactic restrictions against undue or more than ordinary emotional stress might be given for persons with occasional episodes of complex arrhythmias or arrhythmias associated with undue or more than ordinary emotional stress documented by Holter monitoring and a diary; angina with undue or more than ordinary stress; compensated heart failure; hypertension shown to become uncontrolled—with diastolic blood pressures above 100 mm of mercury more than half of the time—under undue or more than ordinary emotional stress; or ECG demonstrations of silent ischemia under undue or more than ordinary emotional stress documented by Holter monitoring and a diary.

Prophylactic restrictions against extreme emotional stress might be given for persons with arrhythmia precipitated by severe emotional stress documented by Holter monitoring and a diary; angina precipitated by severe emotional stress; worsening congestive heart failure precipitated by severe emotional stress; hypertension that becomes uncontrolled by severe emotional stress; or ECG demonstration of silent ischemia with severe emotional stress documented by Holter monitoring and a diary.

### Disability Rating

Following the preceding Guidelines for Evaluating Cardiac Impairment, the physician examiner should summarize the evidence for the six possible factors of impairment (Table 4).<sup>18-24</sup>

The physician may interpolate between the levels in Table 4. Consideration should be given to the need for maximum short-term effort—less than 15 minutes once a day—in certain occupations. The 80% or 70% (see guidelines) level in mets of the person's testing end point should meet or exceed this maximum short-term mets requirement. Also, guidelines for evaluating cardiac impairment due to coronary artery spasm, arrhythmias, hypertension, emotional stress, and a documented history of myocardial infarction, coronary artery operation, or coronary angioplasty, as mentioned earlier, should be considered (see step 3, Table 4). All rat-

TABLE 4.—Method of Calculating Disability Rating

#### Step 1 Find the share of job market loss; this is the uncorrected disability rating

Column 1 If mets Capacity for Sustained Work (45% of test end) Is	Column 2 % Share of Job Market Loss Is*
5.0	10
4.3	20
3.8	30
3.4	40
3.0	50
2.6	60
2.2	70
1.9	80
1.5	90

#### Step 2 Find the share of job market loss related to age and sex; subtracting this figure from the uncorrected disability rating gives the corrected disability rating—the disability percentage not due to age and sex

Column 3 45% of Mean 'Normal' (for age and sex) Vo <sub>2</sub> max† Is		Column 4 % Share of Job Market Loss Related to Age and Sex Is	
Age, yr	Men, mets	Women, mets	
20-29 . . . .	5.0	3.9	10
30-39 . . . .	4.7	3.9	13
40-49 . . . .	4.5	3.4	15
50-59 . . . .	4.2	3.2	19
60+ . . . . .	3.7	2.8	32

#### Step 3 The corrected disability rating may be amended by considering the presence of coronary artery spasm, arrhythmias, hypertension, emotional stress, myocardial infarct, or cardiac surgery

#### Step 4 The corrected disability rating represents combined cardiac and pulmonary (if any) disability; apportionment may be appropriate after determining pulmonary disability by other means

**Example:** Supposing the mets capacity of a 35-year-old man for sustained work (column 1) is determined to be 3.4 mets. This excludes that person from 40% of the job market (column 2). 45% of the mean "normal" mets capacity for a 35-year-old man is 4.7 mets (column 3), which means that a "normal" 35-year-old man is on the average excluded from 13% of the job market (column 4). 40% minus 13% equals 27% loss of job market that is not due to age and sex, so 27% is the disability rating attributable to the heart impairment. This percentage may be modified as in steps 3 and 4.

\*From the California State Employment Development Department, 18-22 and Passmore and Durnin, 23, 24.

†Calculated from Table 3.

ings are "standard," subject to modification for age and occupation.

The summary of medical evidence prepared, as described here, will make it possible to rate a person's disability accurately. If there is disagreement between examiners about the evidence, the adjudicator can easily compare two or more summaries to determine which one has the more credible evidence or which points of disagreement should be explored further. Physicians experienced in workers' compensation, who may themselves wish to attempt disability ratings, will find the summary of evidence gives a logical, scientifically sound basis for such ratings.

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